

WHAT IS CLAIMED IS:

1. A method for measuring amplified spontaneous emission (ASE) content in a beam of light, the beam of light including a main-emission-line of amplified stimulated emission together with the amplified spontaneous emission, the method comprising the 5 steps of:
  - directing the beam of light into an interferometer;
  - in the interferometer, directing first and second portions of the beam of light along first and second paths, said first and second paths having a different length;
- 10 combining said first and second portions of the beam of light from said first and second paths on a third path such that said beam portions interfere to provide interference pattern comprising bright and dark fringes;
- measuring the light intensity of one or more of said bright fringes and in one or more of said dark fringes; and
- 15 determining from said bright and dark fringe intensity measurements the ASE content of the beam of light.

  

2. The method of claim 1, wherein said first and second beam portions interfering on said third path have about equal amplitude.

  

- 20 3. The method of claim 1, wherein said difference in length of said first and second paths is about equal to or greater than the coherence length of the ASE.

  

- 25 4. The method of claim 3, wherein said difference in length of said first and second paths is between about equal to and four times the coherence length the ASE.

  

- 30 5. The method of claim 1, wherein a said dark fringe has a measured minimum intensity  $I_{min}$  and a said bright fringe has a measured intensity  $I_{max}$ , and said ASE content is determined from an equation
$$E_{incoh}/E_{tot} = 2 \cdot I_{min} / (I_{max} + I_{min})$$
where  $E_{incoh}/E_{tot}$  is the ratio of the ASE light content to total light in the beam of light.

6. The method of claim 1, wherein said measuring step includes providing a spectrometer, measuring in said spectrometer the maximum intensity of a said bright fringe and determining from said measurement the intensity of said light in said main emission-line, forming in said spectrophotometer a spectrum of light in a said dark fringe, and determining from said spectrum determining the intensity of the ASE.

7. The method of claim 6, wherein said spectrum includes a background level including a smoothly varying modulated portion, said smoothly varying modulated portion resulting from said different path lengths in said interferometer and having a maximum intensity  $I_{0(\max)}$  and a minimum intensity  $I_{0(\min)}$  and the ASE is determined from an equation

$$I_i = \Delta\lambda_{ASE} * (I_{0(\max)} - I_{0(\min)})$$

where  $I_i$  is the ASE and  $\Delta\lambda_{ASE}$  is the spectral width of the ASE.

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8. A method for measuring amplified spontaneous emission (ASE) content in a beam of light, the beam of light including a main-emission-line light content of amplified stimulated emission together with the amplified spontaneous emission, the method comprising the steps of:

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directing the beam of light into an interferometer;

in the interferometer, directing first and second portions of the beam of light along first and second paths, said first and second paths having a different length;

25 combining said first and second portions of the beam of light from said first and second paths on a third path such that said beam portions interfere to provide interference pattern comprising bright and dark fringes;

measuring, in a spectrometer the light intensity of one or more of said bright fringes and in one or more of said dark fringes;

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measuring in a spectrometer the maximum intensity of a said bright fringe and determining from said measurement the intensity of said light in said main emission-line; and

forming in said spectrometer a spectrum of light in a said dark fringe, and determining from said spectrum determining the intensity of the ASE.

9. The method of claim 8, wherein said spectrum includes a background level including a smoothly varying modulated portion, said smoothly varying modulated portion resulting from said different path lengths in said interferometer, and having a maximum intensity  $I_{0(\max)}$  and a minimum intensity  $I_{0(\min)}$  and wherein the ASE is determined from an equation

$$I_i = \Delta\lambda_{ASE} * (I_{0(\max)} - I_{0(\min)})$$

10 where  $I_i$  is the ASE and  $\Delta\lambda_{ASE}$  is the spectral width of the ASE.

10. Apparatus for measuring amplified spontaneous emission (ASE) content in a beam of light, the beam of light including a main emission-line of amplified stimulated emission together with the amplified spontaneous emission, the apparatus comprising:

an interferometer, said interferometer arranged to direct first and second portions of the beam of light along first and second paths, said first and second paths having a different length, said difference in length of said first and second paths being about equal to or greater than the coherence length of the ASE, but less than the coherence length of light in said main emission-line;

20 said interferometer further arranged to combine said first and second portions of the beam of light from said first and second paths on a third path wherein as a result of said beam path difference only the main emission-line light portion of said light beam portions interferes and provides an interference pattern comprising bright and dark fringes; and

25 one of a detector and a spectrometer arranged to measuring the light intensity in one or more of said bright fringes and in one or more of said dark fringes.

11. The apparatus of claim 10, wherein said interferometer is further arranged such that said first and second beam portions interfering on said third path have about equal amplitude.

5 12. The apparatus of claim 10, wherein said difference in length of said first and second paths is between about equal to and four times the coherence length the ASE.

10 13. The apparatus of claim 10, wherein said interferometer includes first and second transparent plates arranged spaced apart and parallel to each other and inclined to the beam of light to be measured, each of said plates having first and second opposite parallel surfaces and wherein there are first and second optical delay elements disposed between said plates said first and second delay elements being in said first and second beam paths respectively, and said first delay element having a length different from the length of said second gain element for causing said first and second beam paths to have 15 said different length.

20 14. The apparatus of claim 13, wherein said light beam is incident on said first plate, wherein, in said first path, light is transmitted through said second surface of said first plate, transmitted through said first delay element, transmitted through said first surface of said second plate, reflected from said second surface of said second plate, and reflected from said first surface of said second plate, and wherein, in said second path, light is reflected from said second surface of said first plate at a point thereon where said first-path light is transmitted therethrough, reflected from said first surface of said first plate, transmitted through said second surface of said first plate, transmitted through said 25 second optical delay element and transmitted through said first surface of said second plate at a point thereon where said first-path light is reflected therefrom.

15. The apparatus of claim 14, wherein the light beam is incident on said first plate at an angle between about 20 degrees and 30 degrees.

16. The apparatus of claim 13, wherein said light beam is incident on said second plate, wherein, in said first path, light is transmitted through said first surface of said second plate, reflected from said second surface of said second plate, transmitted through said first surface of said second plate, transmitted through said first delay element, and reflected from said second surface of said first plate, and wherein, in said second path, light is reflected from said first surface of said second plate at a point thereon where said first-path light is transmitted therethrough, transmitted through said second delay element, transmitted through said second surface of said first plate, reflected from said first surface of said first plate, and transmitted through said second surface of said first plate at a point thereon where said first-path light is reflected therefrom.

17. The apparatus of claim 16, wherein the light beam is incident on said second plate at an angle greater than about 50 degrees.

18. The apparatus of claim 17, wherein said light beam is plane polarized, and wherein said plates are arranged such that the polarization plane of said light is perpendicular to the plane of incidence of light on said second plate.

19. The apparatus of claim 10, wherein said interferometer includes a transparent plate having first and second opposite parallel surfaces and inclined to the beam of light to be measured at an angle of about 45 degrees, first and second mirrors inclined at 90 degrees to each other and disposed in said first path inclined at 45 degrees thereto, on said first-surface side of said plate at a first distance therefrom, and third and fourth mirrors inclined at 90 degrees to each other and disposed in said second path inclined at 45 degrees thereto on said second-surface side of said plate at a second distance therefrom, said first and second distances being different for creating said path length difference.

20. The apparatus of claim 19, wherein said light beam is incident on said first surface of said plate at an angle of 45 degrees thereto, wherein, in said first path, light is reflected from said first surface of said plate, reflected sequentially from said first and

second mirrors, transmitted through said first surface of said plate and transmitted through said second surface of said plate and wherein in said second path, light is transmitted through said first surface of said plate at a point thereon where said first-path light is reflected therefrom, transmitted through said second surface of said plate, 5 reflected sequentially from said third and fourth mirrors and reflected from said second surface of said plate at a point thereon where said first-path light is transmitted therethrough.

21. The apparatus of claim 10, wherein a spectrometer is used to measure said 10 light intensity in said light and dark fringes.

22. The apparatus of claim 21, wherein said dark fringe intensity measurement includes a spectrum of light in said dark fringe said spectrum including a smoothly modulated portion resulting from the beam path difference in the interferometer causing 15 interference of the ASE content of the dark fringe light in the spectrometer, said smoothly modulated portion surmounting a uniform portion resulting from scattering in the spectrometer of residual main emission-line light content of the dark fringe light.

23. An apparatus for measuring amplified spontaneous emission (ASE) 20 content in a beam of light, the beam of light including a main emission-line of amplified stimulated emission together with the amplified spontaneous emission, the apparatus comprising:

an interferometer, said interferometer arranged to direct first and second portions of the beam of light along first and second paths, said first and second paths having a different length, said difference in length of said first and second paths being about equal to or greater than the coherence length of the ASE, but less than the coherence length of light in said main emission-line; 25

said interferometer further arranged to combine said first and second portions of the beam of light from said first and second paths on a third path 30 wherein as a result of said beam path difference only the main emission-line light

portion of said light beam portions interferes and provides an interference pattern comprising bright and dark fringes;

a spectrometer arranged to measure the light intensity in one or more of said bright fringes and in one or more of said dark fringes; and

5           said dark fringe intensity measurement includes a spectrum of light in said dark fringe said spectrum including a smoothly modulated portion resulting from the beam path difference in the interferometer causing interference of the ASE content of the dark fringe light in the spectrometer, said smoothly modulated portion surmounting a uniform portion resulting from scattering in the  
10          spectrometer of residual main emission-line light content of the dark fringe light.